Genesis of high-Mg andesites at White Island, New Zealand

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On White Island, New Zealand, the intensified period of strombolian-volcanian and phreatomagmatic explosive activity that commenced in March 1977 led to eruption of unusually primitive, high-Mg andesites. These are Fo_{80-93} olivine-saturated rocks that have MgO contents up to 10% (Mg# = 65-71) and SiO_2 of 56-58%. They have incompatible trace element characteristics that are typical of arc rocks. $^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$ and $^{176}Hf/^{177}Hf$ ratios (0.7049-0.7053, 0.51282-0.51266 and 0.28301-0.28298, respectively) are consistent with subducted sediment addition and/or crustal input but there is no clear correlation of either isotope ratio with MgO. The rocks have modest (3-10%) ^{238}U excesses at low ($^{230}Th/^{232}Th$) ratios (0.697 to 0.722). ^{226}Ra-^{230}Th disequilibria is also restricted but, unusually, includes both ^{226}Ra excesses and deficits with ($^{226}Ra/^{230}Th$) = 0.94-1.07. $(^{210}Pb/^{226}Ra)_o$ ranges from 0.98 to 1.52 requiring gas accumulation that may increase over time and with decreasing MgO. Sr/Y and Tb/Yb ratios are both low and relatively invariant at 8 and 0.3, respectively, and along with the ^{238}U excesses preclude an origin in which residual garnet was involved. The occurrence of some ^{226}Ra deficits suggests the presence of residual amphibole during partial melting for some samples. Rapid magma ascent (to preserve the ^{226}Ra disequilibria) limits the amount of possible melt – wall rock interaction that might reduce source-derived Tb/Yb ratios and in the mantle or raise $^{87}Sr/^{86}Sr$ in the crust. The White Island high-Mg andesites did not form by partial melting of eclogite in the subducting Pacific plate. Their primitive, olivine-saturated compositions suggest that their source was peridotitic and experimental data suggest that melting at low temperatures at 0.5-1.5 GPa and in the presence of elevated alkalis can reconcile the high SiO_2 and MgO of the rocks. These conditions appear to be favoured by the location beneath continental, rather than oceanic lithosphere.

Seasonal and interannual changes in Ca and Mg of dripping waters in Kaite Cave (Spain)

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Kaite, a karstic cave of N Spain, features key advantages to establish a linkage between calcite precipitation and environmental variations. The site is characterized by a stable cave climate: the temperature is 10.40 ± 0.02 ºC and reflects the mean annual temperature outside the cave, the relative humidity exceeds always 99 % and there are not significant air currents. Two points with low and moderate-rapid drip rate (KT-WL and KT-WR, respectively) were selected for the study.

Calcium concentration ranges from 0.82 to 2.17 mmol/L in KT-WL and from 2.17 to 3.57 mmol/L in KT-WR, with a declining concentration trend from 2002 to present in both sites. There is a cyclic pattern related to seasons, very discernible in KT-WL and more erratic in KT-WR. Each intra-annual cycle has a $[Ca^{2+}]$ maximum peak during the summer, when precipitation is lower and temperature is higher. In addition there are inter-annual variations of calcium concentration, which present a similar pattern in the two points monitored. In both cases there is an initial trend of decreasing from the beginning of the monitoring program to end-2005, which changes to a slight increase in 2006-2007. The trend of decreasing of calcium concentration through the years correlates with the net decreasing of rainfall in the area from the beginning of the monitoring program and with an increasing in the temperature, especially that of colder seasons. $[Ca^{2+}]$ does not correlate with $[Mg^{2+}]$ (r = 0.12 in KT-WL and r = 0.14 in KT-WR), reflecting that drip water should not be affected by a dilution process when precipitation increases. Therefore, in response to the rainfall decrease, the inter-annual signal shows a progressive decrease in calcite growth. Relationships between Ca and Mg, Sr and Ba suggest prior calcite precipitation, which is considered a long-term (years) water-rock interaction process as a consequence of the prolonged dryness situation.

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